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Exercise - I (Conceptual Questions) Build Up Your Understanding

FACTORS AFFECTING RATE OF REACTION

1. In an elementary reaction $A + 2B \rightarrow 2C + D$. If the concentration of A is increased four times and B is decreased to half of its initial concentration then the rate becomes
(1) Twice
(2) Half
(3) Unchanged
(4) One fourth of the rate

2. The role of catalyst in a chemical reaction is :-
(1) To help attain equilibrium in a shorter time.
(2) To lower the activation energy.
(3) To shift the equilibrium in such a way as to increase the concentration of the product
(4) Both 1 & 2

EQUILIBRIUM AND CHEMICAL PROCESS

3. $x \rightleftharpoons y$ reaction is said to be in equilibrium, when:-
(1) Only 10% conversion x to y takes place.
(2) Complete conversion of x to y takes place
(3) Conversion of x to y is only 50% complete
(4) The rate of change of x to y is just equal to the rate of change of y to x in the system

4. In the chemical reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at equilibrium, state whether :-
(1) Equal volumes of N_2 & H_2 are reacting
(2) Equal masses of N_2 & H_2 are reacting
(3) The reaction has stopped
(4) The same amount of ammonia is formed as is decomposed into N_2 and H_2 in the same time

5. Active mass of 5 g CaO is :-
(1) 56 (2) 1 (3) 3.5 (4) 2

6. Ratio of active masses of 22g CO_2, 3g H_2 and 7g N_2 in a gaseous mixture is :-
(1) 22 : 3 : 7 (2) 0.5: 3 : 7
(3) 1 : 3 : 1 (4) 1 : 3 : 0.5

7. Which of the following example shows effect of catalyst on reversible reaction
(1) It gives new reaction path with low activation energy.
(2) It shifts equilibrium right side.
(3) It decreases kinetic energy of activated molecules.
(4) It decreases rate of backward reaction.

8. In reversible chemical reaction equilibrium will establish when –
(1) Reactant is completely converted into product
(2) Rate of forward and backward reaction is equal
(3) Minimum yield of product
(4) concentration of reactant and product is equal

LAW OF MASS ACTION

9. In a chemical equilibrium, the rate constant for the backward reaction is 7.5×10^{-4} and the equilibrium constant is 1.5. The rate constant for the forward reaction is:-
(1) 2×10^{-3} (2) 5×10^{-4}
(3) 1.12×10^{-3} (4) 9.0×10^{-4}

10. The equilibrium concentration of B for the reversible reaction $A \rightleftharpoons B$ can be evaluated by the expression:-
(1) $K_c[A]_e^{-1}$ (2) $\frac{k_f}{k_b}[A]_e^{-1}$
(3) $k_f k_b^{-1}[A]_e$ (4) $k_f k_b [A]_e^{-1}$

11. In this reaction $Ag^+ + 2NH_3 \rightleftharpoons Ag(NH_3)_2^+$ at 298K molar concentration of Ag^+, $Ag(NH_3)_2^+$ and NH_3 is 10^{-1}, 10^{-1}, and 10^3. The value of K_C at 298K for this equilibrium :-
(1) 10^{-6} (2) 10^6
(3) 2×10^{-3} (4) 2×10^6

12. At 1000 K, the value of K_P for the reaction :
$A(g) + 2B(g) \rightleftharpoons 3C(g) + D(g)$
is 0.05 atm. The value of K_C in terms of R would be :-
(1) 20000 R (2) 0.02 R
(3) 5×10^{-5} R (4) $5 \times 10^{-5} \times R^{-1}$

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13. For the reaction $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ the partial pressure of CO and CO_2 are 2.0 and 4.0 atm respectively at equilibrium. The K_P for the reaction is

(1) 0.5 (2) 4.0 (3) 8.0 (4) 1

14. For which reaction is $K_p = K_c$:-

(1) $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$

(2) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(3) $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$

(4) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

15. For the reaction

$CuSO_4.5H_2O_{(s)} \rightleftharpoons CuSO_4.3H_2O_{(s)} + 2H_2O_{(g)}$

Which one is correct representation :–

(1) $K_p = p^2_{H_2O}$ (2) $K_c = [H_2O]^2$

(3) $K_p = K_c(RT)^2$ (4) All of these

16. $\log \frac{K_p}{K_c} + \log RT = 0$ is true relationship for the following reaction:-

(1) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

(2) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

(3) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

(4) (2) and (3) both

17. For which reaction at 298 K, the value $\frac{K_p}{K_c}$ of is maximum and minimum respectively:-

(a) $N_2O_4 \rightleftharpoons 2NO_2$

(b) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

(c) $X + Y \rightleftharpoons 4Z$

(d) $A + 3B \rightleftharpoons 7C$

(1) d, c (2) d, b (3) c, b (4) d, a

18. Consider the two gaseous equilibrium involving SO_2 and the corresponding equilibrium constants at 299 K

$SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$; K_1

$4SO_3(g) \rightleftharpoons 4SO_2(g) + 2O_2(g)$; K_2

The value of the equilibrium constants are related by :-

(1) $K_2 = \frac{1}{(K_1)^4}$ (2) $K_2 = K_1^4$

(3) $K_2 = \left(\frac{1}{K_1}\right)^{\frac{1}{4}}$ (4) $K_2 = \frac{1}{K_1}$

19. For the reactions :- $A \rightleftharpoons B$; $K_C = 2$, $B \rightleftharpoons C$; $K_C = 4$, $C \rightleftharpoons D$; $K_C = 6$

K_C for the reaction $A \rightleftharpoons D$:-

(1) 12 (2) 4/3 (3) 24 (4) 48

20. Which Oxide of Nitrogen is most stable :-

(1) $2NO_{2(g)} \rightleftharpoons N_{2(g)} + 2O_{2(g)}$
$K = 6.7 \times 10^{16}$ mol L^{-1}

(2) $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$
$K = 2.2 \times 10^{30}$

(3) $2N_2O_{5(g)} \rightleftharpoons 2N_{2(g)} + 5O_{2(g)}$
$K = 1.2 \times 10^{34}$ mol^5 L^{-5}

(4) $2N_2O_{(g)} \rightleftharpoons 2N_{2(g)} + O_{2(g)}$
$K = 3.5 \times 10^{33}$ mol L^{-1}

21. The equilibrium constant in a reversible reaction at a given temperature:-

(1) Depends on initial concentration of the reactants.

(2) Depends on the concentration of the products at equilibrium.

(3) Does not depend on the initial concentrations.

(4) It is not characteristic of the reaction.

22. Which one of the following statements is correct about equilibrium constant:-

(1) Equilibrium constant of a reaction changes with temperature.

(2) Equilibrium constant of a reaction depends upon the concentration of reactants with which we start.

(3) Equilibrium constant of a reaction, $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$ is same whether, the reaction is carried out in an open vessel or a closed vessel.

(4) Equilibrium constant of a reaction becomes double if the reaction is multiplied by 2 throughout.

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23. For a reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of K_c does not depends upon :-
(a) Initial concentration of the reactants
(b) Pressure
(c) Temperature
(d) Catalyst
(1) Only c (2) a, b, c
(3) a, b, d (4) a, b, c, d

24. For any reversible reaction if concentration of reactants increases then value of equilibrium constant :-
(1) Depends on amount of concentration
(2) Unchanged
(3) Decreases
(4) Increases

25. Effect of increasing temperature on equilibrium constant is given by

$$\log K_2 - \log K_1 = \frac{-\Delta H^\circ}{2.303R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$$

then for an endothermic reaction the false statement is:-
(1) $\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$ = positive (2) $\log K_2 > \log K_1$
(3) ΔH = positive (4) $K_2 > K_1$

26. The equilibrium constant for the reaction $Br_2 \rightleftharpoons 2Br$ at 500 K and 700 K are 1×10^{-10} and 1×10^{-5} respectively. The reaction is:-
(1) Endothermic (2) Exothermic
(3) Fast (4) Slow

27. In an experiment the equilibrium constant for the reaction $A + B \rightleftharpoons C + D$ is K when the initial concentration of A and B each is 0.1 mol L^{-1} Under the similar conditions in an another experiment if the initial concentration of A and B are taken 2 and 3 mol L^{-1} respectively then the value of equilibrium constant will be:-
(1) $\frac{K}{2}$ (2) K
(3) K^2 (4) $\frac{1}{K}$

28. In system $A(s) \rightleftharpoons 2B(g) + 3C(g)$ at equilibrium if concentration of 'C' is doubled then concentration of B at equilibrium will be :-
(1) Double its original concentration
(2) Half its original concentration
(3) $2\sqrt{2}$ its original concentration
(4) $\frac{1}{2\sqrt{2}}$ its original concentration

29. For the reaction, $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ equilibrium constant, K_P changes with :-
(1) Temperature
(2) Total pressure
(3) Catalyst
(4) Amount of H_2 and I_2 present

30. The equilibrium constant (K_P) for the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is 16. If the volume of the container is reduced to one-half its original volume, the value of K_P for the reaction at the same temperature will be :-
(1) 32 (2) 64 (3) 16 (4) 4

31. The equilibrium constant of the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is 64. If the volume of the container is reduced to one fourth of its original volume, the value of the equilibrium constant will be
(1) 16 (2) 32 (3) 64 (4) 128

32. If some He gas is introduced into the equilibrium $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ at constant pressure and temperature then equilibrium constant of reaction :
(1) Increases
(2) Decreases
(3) Unchanged
(4) Nothing can be said

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33.

	List X		List Y
(A)	Active mass	(I)	$\Delta n = 0$
(B)	Dynamic nature	(II)	Molar concentration
(C)	A + heat $\rightleftharpoons$ B	(III)	Vant hoff's equation
(D)	log (K_{p2}/K_{p1})	(IV)	adaptation if temperature increases $= \frac{\Delta H^{o}}{2.303R}\left[\frac{1}{T_1}-\frac{1}{T_2}\right]$
(E)	$2A(g)+B(g) \rightleftharpoons 3C(g)$	(v)	Chemical equilibrium

Correct match list X and Y

(1) A - (V), B - (II), C - (III), D - (I), E - (IV)

(2) A - (V), B - (IV), C - (III), D - (II), E - (I)

(3) A - (II), B - (V), C - (IV), D - (III), E - (I)

(4) None of these

DEGREE OF DISSOCIATION AND APPLICATION OF LAW OF MASS ACTION

34. For the reaction : P $\rightleftharpoons$ Q + R. Initially 2 mol of P was taken. Up to equilibrium 0.5 mol of P was dissociated. What would be the degree of dissociation :-

(1) 0.5 (2) 1 (3) 0.25 (4) 4.2

35. The dissociation of CO_2 can be expressed as $2CO_2 \rightleftharpoons 2CO + O_2$. If the 2 mol of CO_2 is taken initially and 40% of the CO_2 is dissociated completely. What is the total number of moles at equilibrium:-

(1) 2.4 (2) 2.0 (3) 1.2 (4) 5

36. In $A_3(g) \rightleftharpoons 3A\ (g)$ reaction, the initial concentration of A_3 is "a" mol L^{-1} If x is degree of dissociation of A_3. The total number of moles at equilibrium will be:-

(1) $a - \frac{ax}{3}$ (2) $\frac{a}{3} - x$

(3) $\left(\frac{a-ax}{2}\right)$ (4) a + 2 ax

37. In the reaction $2P(g) + Q(g) \rightleftharpoons 3R(g) + S(g)$. If 2 mol each of P and Q taken initially in a 1 L flask. At equilibrium which is true:-

(1) [P] < [Q] (2) [P] = [Q]

(3) [Q] = [R] (4) None of these

38. The reaction A + B $\rightleftharpoons$ C + D is studied in a one litre Vessel at 250°C. The initial concentration of A was 3n and of B was n. After equilibrium was attained then equilibrium concentration of C was found to be equal to equilibrium concentration of B. What is the concentration of D at equilibrium :-

(1) $\frac{n}{2}$ (2) $\left(3n-\frac{n}{2}\right)$

(3) $\left(n+\frac{n}{2}\right)$ (4) n

39. $X_2 + Y_2 \rightleftharpoons 2XY$ reaction was studied at a certain temperature. In the beginning 1 mole of X_2 was taken in a one litre flask and 2 moles of Y_2 was taken in another 2litre flask. What is the equilibrium concentration of X_2 and Y_2 ? (Given equilibrium concentration of [XY] = 0.6 mol L^{-1}).

(1) $\left(\frac{1}{3}-0.3\right),\left(\frac{2}{3}-0.3\right)$

(2) $\left(\frac{1}{3}-0.6\right),\left(\frac{2}{3}-0.6\right)$

(3) (1 – 0.3), (2 – 0.3)

(4) (1 – 0.6), (2 – 0.6)

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40. In a 20 litre vessel initially 1 - 1 mole CO, H_2O, CO_2 is present, then for the equilibrium of $CO + H_2O \rightleftharpoons CO_2 + H_2$ following is true:-

(1) H_2, more than 1 mole

(2) CO, H_2O, H_2 less than 1 mole

(3) CO_2 & H_2O both more than 1 mole

(4) All of these

41. 4 mole of PCl_5 are heated at constant temperature in closed container. If degree of dissociation for PCl_5 is 0.5 then calculate total number of moles at equilibrium

(1) 4.5 (2) 6 (3) 3 (4) 4

42. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

In above reaction, at equilibrium condition mole fraction of PCl_5 is 0.4 and mole fraction of Cl_2 is 0.3. Then find out mole fraction of PCl_3

(1) 0.3 (2) 0.7 (3) 0.4 (4) 0.6

43. If 8 mole of PCl_5 is heated in a closed vessel of 10 L capacity and 25% of it dissociates into PCl_3 and Cl_2 at the equilibrium then value of Kp will be [Given : Total equilibrium pressure is P]

(1) P/30 (2) P/15 (3) 2/3P (4) 3/2P

44. In the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ the partial pressure of PCl_3, Cl_2 and PCl_5 are 0.3, 0.2 and 0.6 atm respectively at equilibrium. If partial pressure of PCl_3 and Cl_2 was twice at new equilibrium, what will be the partial pressure of PCl_5 is in atm at new equilibrium condition :-

(1) 0.3 (2) 1.2 (3) 2.4 (4) 0.15

45. 'a' mol of PCl_5, undergoes, thermal dissociation as: $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the mole fraction of PCl_3 at equilibrium is 0.25 and the total pressure is 2.0 atm. The partial pressure of Cl_2 at equilibrium is:-

(1) 2.5 (2) 1.0 (3) 0.5 (4) None

46. In a 0.25 L tube dissociation of 4 mol of NO takes place. If its degree of dissociation is 10%. The value of K_P for reaction $2\,NO \rightleftharpoons N_2 + O_2$ is :-

(1) $\frac{1}{(18)^2}$ (2) $\frac{1}{(8)^2}$ (3) $\frac{1}{16}$ (4) $\frac{1}{32}$

47. In a chemical equilibrium $A + B \rightleftharpoons C + D$ when one mole each of the two reactants are mixed, 0.4 mol each of the products are formed. The equilibrium constant is :-

(1) 1 (2) 0.36 (3) 2.25 (4) $\frac{4}{9}$

48. K_C for the esterification reaction :

$CH_3COOH(\ell) + C_2H_5OH(\ell) \rightleftharpoons CH_3COOC_2H_5(\ell) + H_2O(\ell)$

is 4. If 4 mol each of acid and alcohol are taken initially, what is the equilibrium concentration of the acid :-

(1) $\frac{2}{3}$ (2) $\frac{4}{3}$ (3) $\frac{3}{4}$ (4) $\frac{3}{2}$

49. Evaluate K_P for the reaction : $H_2 + I_2 \rightleftharpoons 2HI$. If 2 moles each of H_2 and I_2 are taken initially. At equilibrium moles of HI are 2.

(1) 2.5 (2) 4 (3) 0.25 (4) 1.0

50. 4 moles of A are mixed with 4 moles of B, when 2 mol of C are formed at equilibrium, according to the reaction, $A + B \rightleftharpoons C + D$. The equilibrium constant is :-

(1) 4 (2) 1 (3) $\sqrt{2}$ (4) $\sqrt{4}$

51. Two moles of ammonia is introduced in a evacuated 500 mL vessel at high temperature. The decomposition reaction is :

$2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$

At the equilibrium NH_3 becomes 1 mole then the K would be :-

(1) 0.42 (2) 6.75 (3) 1.7 (4) 1.5

52. 4.5 mol each of hydrogen and iodine heated in a sealed 10 litre vessel. At equilibrium, 3 mol of HI were found. The equilibrium constant for $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ is:-

(1) 1 (2) 10 (3) 5 (4) 0.33

53. AB dissociates as $2AB(g) \rightleftharpoons 2A(g) + B_2(g)$

When the initial pressure of AB is 500 mm, the total pressure becomes 625 mm when the equilibrium is attained. Calculate K_P for the reaction assuming volume remains constant.

(1) 500 (2) 125 (3) 750 (4) 375

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LE-CHATLIER'S PRINCIPLE

54. Cis -2- pentene $\rightleftharpoons$ Trans -2- pentene for the above equilibrium the value of standard free energy change at 400 K is –3.67 kJ mol^{-1}. If excess of trans -2- pentene is added to the system then :-
(1) Additional trans -2- pentene will form
(2) Excess of cis -2- pentene will form
(3) Equilibrium will proceed in the forward
(4) Equilibrium will remain unaffected

55. When $NaNO_3$ is heated in a closed vessel, O_2 is liberated and $NaNO_2$ is left behind. At equilibrium –
(1) Addition of $NaNO_3$ favours forward reaction
(2) Addition of $NaNO_2$ favours reverse reaction
(3) Increasing pressure favours reverse reaction.
(4) Decreasing temperature favours forward reaction.

56. In manufacture of NO, the reaction of N_2 and O_2 to form NO is favourable if :-
(1) Pressure is increased
(2) Pressure is decreased
(3) Temperature is increased
(4) Temperature is decreased

57. In which of the following equilibrium reactions, the equilibrium would shift to right side, if total pressure is decreased :-
(1) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (2) $H_2 + I_2 \rightleftharpoons 2HI$
(3) $N_2O_4 \rightleftharpoons 2NO_2$ (4) $H_2 + Cl_2 \rightleftharpoons 2HCl$

58. The oxidation of SO_2 by O_2 to SO_3 is exothermic reaction. The concentration of SO_2 will be minimum if :-
(1) Temperature is increased and pressure is kept constant
(2) Temperature is reduced and pressure is increased
(3) Both temperature and pressure are increased
(4) Both temperature and pressure are decreased

59. For the manufacture of ammonia by the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3 + 21.9$ kCal, the favourable conditions are :-
(1) Low temperature, low pressure & catalyst
(2) Low temperature, high pressure & catalyst
(3) High temperature, low pressure & catalyst
(4) High temperature, high pressure & catalyst

60. In the reaction $2A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)} + 362$ kCal. Which combination of pressure and temperature gives the highest yield of C at equilibrium:-
(1) 1000 atm and 500°C
(2) 500 atm and 500°C
(3) 1000 atm and 50°C
(4) 500 atm and 100°C

61. Does Le chatelier's principle predict a change of equilibrium concentration for the following reaction if the gas mixture is compressed
$N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$
(1) Yes, backward reaction is favoured
(2) Yes, forward reaction is favoured
(3) No change
(4) No information

62. The reaction in which yield of production cannot be increased by the application of high pressure is :-
(1) $PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$
(2) $N_2(g) + O_2(g) \rightleftharpoons 2NO\ (g)$
(3) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
(4) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

63. In a vessel containing SO_3, SO_2 and O_2 at equilibrium, some helium gas is introduced so that the total pressure increases while temperature and volume remain constant. According to Le-Chatelier principle, the dissociation of SO_3,
(1) Increases (2) Decreases
(3) Remains unaltered (4) None of these

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PHYSICAL EQUILIBRIUM

64. For the equilibrium reaction, $H_2O(\ell) \rightleftharpoons H_2O_{(g)}$,

What happens, if pressure is applied:-

(1) More water evaporates

(2) The boiling point of water is increased

(3) No effect on boiling point

(4) None of the above

65. On cooling of following system at equilibrium $CO_{2(s)} \rightleftharpoons CO_{2(g)}$:-

(1) There is no effect on the equilibrium state

(2) More gas is formed

(3) More gas is solidifies

(4) None of above

CALCULATION OF DEGREE OF DISSOCIATION BY V.D. METHOD

66. Vapour density of PCl_5 is 104.25 at T°C. Then degree of dissociation of PCl_5 is. (Mw = 208.5)

(1) 20% (2) 0% (3) 30% (4) 15%

67. When heating PCl_5 then it decompose PCl_3 and Cl_2 in form of gas, The vapour density of gas mixture is 70.2 and 57.9 at 200° C and 250°C. The degree of dissociation of PCl_5 at 200°C and 250°C is

(1) 48.50% & 80% (2) 60% & 70%

(3) 70% & 80% (4) 80% & 90%

68. The equation $\alpha = \frac{D-d}{(n-1)d}$ is correctly matched for Where D = Theoretical vapour density

d = Observed vapour density

(1) $A \rightleftharpoons \frac{nB}{2} + \frac{nC}{3}$

(2) $A \rightleftharpoons \frac{nB}{3} + \left(\frac{2n}{3}\right)C$

(3) $A \rightleftharpoons \left(\frac{n}{2}\right)B + \left(\frac{n}{4}\right)C$

(4) $A \rightleftharpoons \left(\frac{n}{2}\right)B + C$

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	4	4	4	2	4	1	2	3	3	1	4	4	3	4
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	2	1	4	1	3	1	3	2	1	1	2	4	1	3
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	3	3	3	1	4	1	1	1	2	2	1	2	3	3
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	1	4	2	2	2	2	1	2	2	3	3	3	2	2	3
Question	61	62	63	64	65	66	67	68							
Answer	1	2	3	2	3	2	1	2							

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Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT Pre. 2010

1. The reaction : $2A(g) + B(g) \rightleftharpoons 3C(g) + D(g)$ is start with the concentrations of A and B both at an initial value of 1.00 M. When equilibrium is reached, the concentration of D is measured and found to be 0.25 M. The value for the equilibrium constant for this reaction is given by the expression.

(1) $[(0.75)^3 (0.25)] \div [(0.50)^2 (0.75)]$
(2) $[(0.75)^3 (0.25)] \div [(0.50)^2 (0.25)]$
(3) $[(0.75)^3 (0.25)] \div [(0.75)^2 (0.25)]$
(4) $[(0.75)^3 (0.25)] \div [(1.00)^2 (1.00)]$

AIPMT-Mains 2010

2. In which of the following equilibrium K_c and K_p are not equal ?

(1) $2C_{(s)} + O_{2(g)} \rightleftharpoons 2CO_{2(g)}$
(2) $2NO_{(g)} \rightleftharpoons N_{2(g)} + O_{2(g)}$
(3) $SO_{2(g)} + NO_{2(g)} \rightleftharpoons SO_{3(g)} + NO_{(g)}$
(4) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

AIPMT-Pre 2011

3. For the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the equilibrium constant is K_1. The equilibrium constant is K_2 for the reaction $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$. What is K for the reaction $NO_2(g) \rightleftharpoons \frac{1}{2} N_2(g) + O_2(g)$?

(1) $1/(2K_1K_2)$ (2) $1/(4K_1K_2)$
(3) $[1/K_1K_2]^{1/2}$ (4) $1/(K_1K_2)$

AIPMT-Mains 2012

4. Given that the equilibrium constant for the reaction $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature ?

$SO_{3(g)} \rightleftharpoons SO_{2(g)} + \frac{1}{2} O_{2(g)}$

(1) 6.0×10^{-2} (2) 1.3×10^{-5}
(3) 1.8×10^{-3} (4) 3.6×10^{-3}

5. Given the reaction between 2 gases represented by A_2 and B_2 to give the compound AB(g)

$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}$

At equilibrium, the concentration
of $A_2 = 3.0 \times 10^{-3}$ M
of $B_2 = 4.2 \times 10^{-3}$ M
of AB = 2.8×10^{-3} M

If the reaction takes place in a sealed vessel at 527°C, then the value of K_C will be :-

(1) 0.62 (2) 4.5 (3) 2.0 (4) 1.9

AIPMT 2014

6. For the reversible reaction :

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat$

The equilibrium shifts in forward direction :

(1) By increasing the concentration of $NH_3(g)$
(2) By decreasing the pressure
(3) By decreasing the concentrations of $N_2(g)$ and $H_2(g)$
(4) By increasing pressure and decreasing temperature

7. For a given exothermic reaction, K_p and K'_p are the equilibrium constants at temperatures T_1 and T_2, respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2, it is readily observed that:-

(1) $K_p > K'_p$ (2) $K_p < K'_p$
(3) $K_p = K'_p$ (4) $K_p = \frac{1}{K'_p}$

AIPMT-2015

8. If the value of an equilibrium constant for a particular reaction is 1.6×10^{12}, then at equilibrium the system will contain :-

(1) Mostly reactants
(2) Mostly products
(3) Similar amounts of reactants and products
(4) All reactants

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RE-AIPMT-2015

9. If the equilibrium constant for $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is K, the equilibrium constant for $\frac{1}{2}$ $N_2(g) + \frac{1}{2} O_2(g) \rightleftharpoons NO(g)$ will be:-

(1) K (2) K^2 (3) $K^{1/2}$ (4) $\frac{1}{2}K$

NEET(UG) 2017

10. The equilibrium constant of the following are:

$N_2 + 3H_2 \rightleftharpoons 2NH_3$; K_1

$N_2 + O_2 \rightleftharpoons 2NO$; K_2

$H_2 + \frac{1}{2}O_2 \rightarrow H_2O$; K_3

The equilibrium constant (K) of the reaction :

$2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O$, will be :

(1) $K_2 K_3^3 / K_1$ (2) K_2K_3/K_1

(3) $K_2^3K_3 / K_1$ (4) $K_1K_3^3 / K_2$

11. A 20 litre container at 400 K contains $CO_2(g)$ at pressure 0.4 atm and an excess of SrO (neglect the volume of solid SrO). The volume of the container is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be :-

(Given that : $SrCO_3(s) \rightleftharpoons SrO(s) + CO_2(g)$, Kp = 1.6atm)

(1) 10 litre (2) 4 litre

(3) 2 litre (4) 5 litre

NEET(UG) 2018

12. Which one of the following conditions will favour maximum formation of the product in the reaction,

$A_2(g) + B_2(g) \rightleftharpoons X_2(g)$ $\Delta_rH = -X$ kJ ?

(1) Low temperature and high pressure

(2) Low temperature and low pressure

(3) High temperature and high pressure

(4) High temperature and low pressure

NEET(UG) 2021

13. Equivalent amounts of H_2 and I_2 are heated in a closed container till equilibrium is obtained. If 80% of the hydrogen can be converted to HI, then K_c at this temperature

(1) 64 (2) 16 (3) 0.25 (4) 4

14. Choose the correct option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0°C is: [Given R = 0.082 L atm $mol^{-1}K^{-1}$, T=273K]

(1) 2.518 (2) 2.602

(3) 25.18 (4) 26.02

NEET(UG) 2022

15. Which one is **not** correct mathematical equation for Dalton's Law of partial pressure ? Here p = total pressure of gaseous mixture

(1) $p = n_1\frac{RT}{V} + n_2\frac{RT}{V} + n_3\frac{RT}{V}$

(2) $p_i = \chi_i p$, where p_i = partial pressure of i^{th} gas χ_i = mole fraction of i^{th} gas in gaseous mixture

(3) $p_i = \chi_i p_i^o$, where χ_i, = mole fraction of i^{th} gas in gaseous mixture p_i^o = pressure of i^{th} gas in pure state

(4) $p = p_1 + p_2 + p_3$

16. $3O_2(g) \rightleftharpoons 2O_3(g)$

for the above reaction at 298 K, K_C is found to be 3.0×10^{-59} . If the concentration of O_2 at equilibrium is 0.040 M then concentration of O_3 in M is

(1) 1.9×10^{-63} (2) 2.4×10^{31}

(3) 1.2×10^{21} (4) 4.38×10^{-32}

17. K_P for the following reaction is 3.0 at 1000 K.

$CO_2(g) + C(s) \rightleftharpoons 2CO(g)$

What will be the value of K_C for the reaction at the same temperature ?

(Given - R = 0.083 L bar K^{-1} mol^{-1})

(1) 0.36 (2) 3.6×10^{-2}

(3) 3.6×10^{-3} (4) 3.6

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	1	3	1	1	4	1	2	3	1	4	1	1	3	3
Question	16	17													
Answer	4	2													

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Exercise – III (Analytical Questions) Master Your Understanding

1. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .

Assertion (A) : For any chemical reaction at a particular temperature the equilibrium constant is fixed and is a characteristic property.

Reason (R) : Equilibrium constant is independent of temperature.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A).**

(2) **(A)** is correct but **(R)** is not correct.

(3) **(A)** is not correct but **(R)** is correct.

(4) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A).**

2. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .

Assertion (A) : In the dissociation of PCl_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCl_5.

Reason (R) : Equilibrium constant changes only with change in temperature.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A).**

(2) **(A)** is correct but **(R)** is not correct.

(3) **(A)** is not correct but **(R)** is correct.

(4) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A).**

3. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .

Assertion (A) : Solubility of a gas in water decreases with increase in temperature.

Reason (R) : Dissolution of a gas in water is an exothermic process.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A).**

(2) **(A)** is correct but **(R)** is not correct.

(3) **(A)** is not correct but **(R)** is correct.

(4) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A).**

4. Given below are two statements:

Statement-I : Solubility of a gas in liquid increases with increase in pressure of the gas in equilibrium with solution

Statement-II : The dissolution of a gas in liquid is an exothermic process.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both statement I and statement II are incorrect.

(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect but statement II is correct.

(4) Both statements I and statements II are correct.

5. Given below are two statements:

Statement-I : The equilibrium constant for the reverse reaction is equal to the inverse of the equilibrium constant for the forward reaction.

Statement-II : For the equilibrium

$2NOCl\,(g) \rightleftharpoons 2NO(g) + Cl_2(g)$

The value of the equilibrium constant (Kc) is 3.75×10^{-6} at 1069 K then the value of Kp is 3.3×10^{-6}

In the light of the above statements, choose the most appropriate answer from the options given below:

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(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statements I and statements II are correct.

6. Given below are two statements:

Statement-I : At equilibrium the concentrations of $N_2 = 3 \times 10^{-3}$ M, $O_2 = 4.2 \times 10^{-3}$ M and NO $=2.8 \times 10^{-3}$ M in a sealed vessel at 800 K. Then the value of K_C is 0.622 for $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

Statement-II : Reaction quotient$(Q_C) < K_C$ net reaction goes from right to left.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statements I and statements II are correct.

7. Given below are two statements:

Statement-I : The effect of temperature on equilibrium constant is given by vant Hoff's equation

Statement-II : Vant Hoff's equation is :-

$$\log \frac{K_1}{K_2} = \frac{\Delta H^0}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is correct and statement II is incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statements I and statements II are correct.

8. Given below are two statements:

Statement-I : $K_P = K_C$ (Correct for all reactions)

Statement-II : The value of K_{eq} increase when concentration of the reactants are increased.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statements I and statements II are correct.

9. Given below are two statements:

Statement-I : There is no effect on equilibrium constant if inert gas is added to the reaction.

$A(g) + B(g) \rightleftharpoons C(g)$

Statement-II : Equilibrium constant changes only with temperature.

In the light of the above statements, choose the most appropriate answer from the options given belowss:

(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statements I and statements II are correct.

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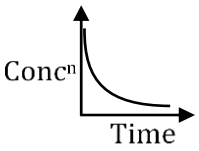
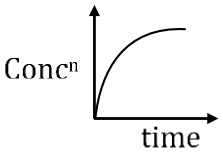
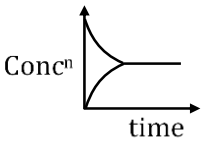
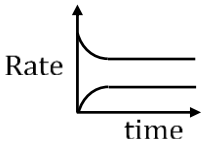
10. For a reaction at equilibrium.
(A) $\Delta G = 0$ (B) $r_{net} = 0$ (C) $r_f = r_b$ (D) $E_{Cell} = 0$
The correct one is :-
(1) C is correct only
(2) A, B, C and D are correct
(3) A, B and C is correct
(4) B, C and D is correct

11. Match List-I with List-II

	List-I		List-II
(a)		(i)	Variation in product concentration with time
(b)		(ii)	Reaction at equilibrium
(c)		(iii)	Variation in reactant concentration
(d)		(iv)	Reaction at Non equilibrium

Choose the correct answer from the option given below :-
(1) (a) → (iii) b → (i) c → (iv) d → (ii)
(2) (a) → (iii) b → (i) c → (ii) d → (iv)
(3) (a) → (i) b → (iii) c → (iv) d → (ii)
(4) (a) → (i) b → (iii) c → (ii) d → (iv)

12. If a chemical reaction is at equilibrium then out of the following :-
(A) $\Delta G = 0$ (B) $K_P = Q_P$
(C) $K_C = 1$ (D) $\Delta G^\circ = 1$
The correct option is :-
(1) A and B (2) B, C and D
(3) A, C and D (4) A, B, C and D

13. Identify the set of correct statement-
(a) If $K_C > 10^3$; products predominate over reactant
(b) If $K_C < 10^{-3}$; reactant predominate over product.
(c) If K_C is in the range of 10^{-3} to 10^3 ; appreciable concentration of both reactant and product are present.
(d) If $Q_C > K_C$ net reaction goes from left to right.
Choose the correct answer from the options given below-
(1) a, b only (2) c, d only
(3) a, b, c only (4) a, b, c, d only

14. For the reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ the value of K_P is 50 at 400 K and 1700 at 500 K.
(a) The reaction is endothermic
(b) The reaction is exothermic
(c) If $NO_2(g)$ and $N_2O_4(g)$ are mixed at 400 K at partial pressure 20 bar and 2 bar respectively, more $N_2O_4(g)$ will be formed
(d) K is independent of temperature
Choose the correct answer from the options given below-
(1) a, b only (2) a, c only
(3) c, d only (4) b, d only

15. If $\Delta G^\circ < 0$ then which is/are true :-
(1) $-\frac{\Delta G^\circ}{RT} > 0$ (2) $e^{-\Delta G^\circ/RT} > 1$
(3) $K > 1$ (4) All of these

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	1	4	4	2	2	2	1	4	2	2	1	3	2	4

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